

MFRC Hits Its Stride

2004 Annual Meeting a Success

Approximately 40 people gathered for the Midwest Forensics Resource Center's 2004 annual meeting, July 15, at the Iowa State University Advancement Center. Members came from crime labs and universities across the organization's 10-state member region. Some of the states and organizations represented included the Minnesota, Wisconsin, Illinois, Missouri, Nebraska and Iowa crime labs. Educators came from universities in North Dakota, South Dakota, Wisconsin, Missouri and Illinois.

Much of the first part of the meeting was spent listening to presentations from researchers whose projects have been funded by the MFRC.

Barbara Lograsso, MFRC research program coordinator, said these projects are designed to lead to development of practical and useful technologies, instrumentation and methods for improving the state of practice of forensic science.

"Anything like this is just what the crime labs need because we just don't have the resources to do it ourselves," said Tom Grant, who's with the Missouri State Highway Patrol Crime Laboratory. "I know we're just starting this, but there are some real benefits coming out already."

George Kraus, director of Ames Lab's Biorenewable Resources Consortium, kicked off the first of four research presentations with an update on the status of his project entitled, "Developing Aptamers to Methamphetamines as Nucleic Acid Sensors." He relayed some frightening statistics about methamphetamine use in Iowa.

According to Kraus, Iowa is now number one in methamphetamine lab seizures per capita in 2004 and more than 12,000 people in Iowa over age 12 report methamphetamine use. "These are

alarming facts," said Kraus, who hopes to help solve this problem or at least help manage it through the development of aptamers for methamphetamines.

Aptamers are single-stranded nucleic acids with advantages over antibodies. Kraus and co-investigator Marit Nilsen-Hamilton, an ISU professor in the biochemistry, biophysics and molecular biology department at ISU and an expert in aptamer research, are working to develop aptamers with high specificity and affinity. Kraus and Nilsen-Hamilton are having some success at tailoring these aptamers to recognize specific molecules, such as those of methamphetamines.

"Our goal is to develop aptamers that will recognize molecules of one compound, such as methamphetamine, and not those of other compounds, such as ecstasy," said Kraus. "We're excited about the opportunity to take these results to the Iowa Department of Criminal Investigation." The Iowa DCI is a partner in the research project.

Research being done for the MFRC is as wide-ranging geographically as it is in its focus. For example, a second research presentation at the annual meeting focused on work being performed by the University of Nebraska involving forensic analysis of trace explosives. In another project, researchers at the Northern Illinois Police Crime Lab are evaluating different systems as extraction methods for mitochondrial DNA analysis.

In an additional effort, the Illinois State Police Forensic Sciences Command is exploring the application of new methods of DNA amplification and expanding population databases of DNA profiles to aid in rape suspect identification.

"More than half our research



MFRC program coordinator Barbara Lograsso chats with Alan Colen, Kansas City, Kansas Community College and a participant in the 2004 MFRC annual meeting, July 15, in Ames.

projects are with external sources," said David Baldwin, director of the MFRC.

In addition to research accomplishments, the MFRC is moving ahead in its other key areas of casework assistance, training, education, and technical innovation in management and infrastructure. In the casework area, the MFRC has just completed development of its quality assurance plan and has begun working on test cases.

In training, the MFRC has developed a users guide on DVD for training in using the DataMaster breath analyzer, a piece of equipment used by authorities to measure alcohol levels in suspected drunk drivers. The MFRC is sending copies of the DVD to sheriffs and prosecutors in all 99 Iowa counties at the request of the Iowa Division of Criminal Investigation.

In education, efforts are being made to form a consortium that,

among other things, will look at issues such as accreditation for university programs in forensic science. Also at the annual meeting, researchers from the ISU College of Business presented their plans to begin a management and infrastructure project studying the implementation of software systems used to manage data within the crime laboratories. This project was slated to begin in July.

Wrapping up the annual meeting, Baldwin said, "We continue to be amazed by the positive feedback we receive on the programs of the MFRC. We couldn't do any of this without the participation and support of the crime-lab community."

~ by Steve Karsjen

Spreading the Word



IPRT Director Tom Barton answers a question during the ISU Economic Development Open House.

IPRT participated in two events this summer to spread the word to Iowa companies about its Company Assistance efforts.

In June, IPRT Company Assistance held a one-day “Nuts and Bolts Workshop” for 11 economic development staff representing eight Iowa community colleges. “The goal for the day was to introduce these people to IPRT’s ability to help Iowa companies,” says Debra Amenson, IPRT Company Assistance coordinator. “They can then go out and tell our story to companies in their region.”

Frank DeMilia, technical/industrial coordinator from Northwest Iowa Community College in Sheldon, Iowa, was one attendee. “The ‘show and tell’ examples will help me when I am out visiting businesses in our area,” he says. “Overall I think it was a day well spent.”

IPRT director Tom Barton kicked off the day with an introduction to IPRT. Joe Gilbert, IPRT associate director, and IPRT technology transfer associates followed with an explanation of how IPRT helps companies meet research and development needs, assists early-stage companies, and facilitates small businesses’ participation in federal research programs. Paul Berge, an IPRT metallurgist, showed how IPRT services help manufacturers address non-routine, materials related issues. Brian Larson, program director, and his team described the basic principles and applications of nondestructive evaluation technology.

In July, Barton gave an overview of IPRT to Iowa companies and economic developers during the ISU Economic Development Open House, “Connect with Iowa State!”

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Grid Creates Collaborative Classes

Starting this fall, the Human Computer Interaction graduate program, housed within IPRT’s Virtual Reality Applications Center, is integrating an innovative technology into the curriculum that promises to enhance the effectiveness of cross-institutional collaborations. The technology is the Access Grid, known as AG: an advanced multimedia technology that supports group-to-group communication through high-quality video and audio over the Web. The AG technology displays multiple video and presentation views simultaneously, which provides a more inclusive and interactive environment.

Currently, Ames Lab has an AG node used for Department of Energy meetings. AG nodes, or “designed spaces,” contain the high-end audio and visual technology needed to provide a high-quality, compelling user experience. The new AG node at VRAC will allow Carolina Cruz-Neira, VRAC associate director and associate professor of industrial and manufacturing systems engineering at Iowa State University, to engage in a cross-institutional collaboration by co-teaching with a former student, Laura Arns, now a research scientist at Purdue University.

The collaboratively taught course, IE 584 Introduction to Virtual Reality, will use the AG as a tool to investigate and evaluate innovative live teaching methods to large groups of students distributed around the world. Students from ISU, Purdue and the University of Indiana will be able to take IE 584 for credit at each of their own institutions. Through the AG, students in all universities will be able to see, hear, and communicate with each other and with the two instructors as if all were in the same physical location.

This type of cross-institutional collaboration is a big step forward from the already very successful distance education activities at ISU. The key difference between the Access Grid and Distance Education courses is that the AG allows for ‘live’ lectures, in that remote students (who are not limited to one location) are as actively involved in each lecture as the local students. One of the expected outcomes of this innovative course is that students will be able to work in cross-institutional teams, thus they will acquire a unique exposure to working on globally distributed teams, which is a growing trend in most industrial sectors. This class is pioneering a new way of training students by leveraging the academic resources at ISU with those of other institutions. The academic efforts of the IE 584 class will be combined with research efforts to develop AG educational tools. In the future, other ISU courses could be offered in this form and therefore reach a much wider national and international student population.

CNDE Wins \$6.5 Million Air Force Contract

IPRT's Center for Nondestructive Evaluation has won a \$6.5 million contract to research nondestructive evaluation techniques for assessing aging of military aircraft. The award, from the Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio, forms a long-term program built on earlier work done by CNDE and the Air Force.

Nondestructive evaluation, or NDE, is the practice of testing a structure's ability to perform its intended function and prevent failure without destroying the sample. This latest CNDE project focuses on improving NDE techniques and applying them to meet the challenges presented by the Air Force's aging fleet, much of which is 25 or more years old.

"It's part of a national response to the increased need for military readiness," said R. Bruce Thompson, CNDE director and a distinguished professor of engineering at ISU. "The ultimate benefit to the Air Force is to have a fleet of aircraft that is available for use a large percentage of the time and that will perform reliably at a minimum cost."

CNDE is a natural fit for the project, according to Thompson. "Our edge is our strong knowledge and experienced staff," he said. Since 1985, the center has worked with the Air Force, Federal Aviation Administration, NASA and industry to apply its NDE expertise to the aerospace industry. "We have a whole bank of techniques, capabilities and ideas that can be drawn upon," Thompson said.

Lisa Brasche, associate director of CNDE, is the co-leader of the Air Force project. "The effort will be a mixture of basic and applied research, including prototype development," she said. The project will involve 15 to 20 CNDE investigators and 10 to 15 graduate and post-doctoral students each year. The majority of the work will be done at ISU, although some subcontractors may be used.

The center has worked with the Air Force to review over 20 NDE technologies to determine which are best suited to meet the Air Force's inspection challenges. For instance, Thompson explained that one goal is to extend the life of critical components such as jet engines. Some parts in a jet engine can cost tens of thousands of dollars. "Clearly, if you don't have to throw away a \$20,000 part because its useful life is extended, that's significant cost savings," Thompson said.

Jet engine components, such as turbine blades, are strengthened with a process called shot peening. Small beads are shot at the part during fabrication, which builds in residual stresses that impede the growth of cracks. Over time, however, the high temperatures and stresses of jet engine operation may cause this residual stress protection to diminish. "You need to be able to measure that stress to know how much of the life of the component remains," Thompson said. Existing methods for measuring residual stress only measure stress in a very thin layer near the surface of a component. Part of CNDE's research is looking at developing improved techniques to measure the stress at a greater depth comparable to that of the shot-peened region.

Another thrust of the program is to study how to apply simulation techniques to the nondestructive evaluation needs of the Air Force. With this approach, computers are used to simulate how to best inspect components for defects. "Simulation allows you to have a rational basis for designing new inspections when a new problem presents itself," Thompson said. "It also provides a much faster way to respond to problems." Moreover, simulations can help assess how well a technique might work. "No technique is perfect, so you always miss some defects, but you want the number you miss to be sufficiently low," Thompson said. CNDE will apply its vast experience in creating computer-based NDE simulation tools to the Air Force program.



Thiel Honored for Program Service



Mark Gordon, director of Applied Mathematics and Computational Sciences and an Iowa State University distinguished professor of chemistry, was elected a member of the International Academy of Quantum Molecular Science at its 41st annual meeting, July 3-4, in Menton, France. The members are chosen among the scientists of all countries who have distinguished themselves by the value of their scientific work, their role of pioneer or leader of a school in the broad field of the

application of quantum mechanics to the study of molecules and macromolecules. Gordon was nominated for membership in the International Academy of Quantum Molecular Science by Klaus Ruedenberg, an Ames Lab associate and an ISU distinguished professor of chemistry, who is also an Academy member.

The American Chemical Society has also honored Gordon with its Midwest Regional Award for his many contributions to the advancement of chemistry during the course of his career. The St. Louis Section of the ACS established the Midwest Award in 1944 to encourage public recognition of outstanding achievement in chemistry in the Midwest Area. The award is conferred annually on a scientist who, while a resident of the Midwest, has made a meritorious contribution to the advancement of pure or applied chemistry or chemical education. Gordon will receive the award at the Midwest Regional Meeting, Oct. 20-22, in Manhattan, Kan.

Gordon's research interests include the development and application of new methods in scalable electronic structure theory, especially for correlated and multi-determinant wavefunctions, and methods for studying environmental effects on reaction mechanisms, all in the electronic structure code GAMESS – General Atomic and Molecular Electronic Structure System. The common motivation throughout all of Gordon's research is to develop an understanding of the mechanisms of chemical reactions in ground and excited electronic states.



Pat Thiel was honored on June 28 by colleagues, family and friends for her contributions to Ames Laboratory as program director for Materials Chemistry. At her reception, Director Tom Barton thanked Thiel for 16 years as program director, priding himself on being the one who hired her for the job in 1988. Barton presented Thiel a plaque from her friends in Materials Chemistry. Said Thiel, "I've really had fun working with all of you. Luckily, I'm not retiring so I still will." Thiel's replacement is Surya Mallapragada, who assumed the program director duties July 1.

Help Support the United Way

ISU is preparing to kick off the 2004 United Way Campaign. The goal for Ames Lab/IPRT is \$13,500. As in the past, all contributions will be kept confidential. Go to www.iastate.edu/uw/ for more information.



Hard Hat Open

What's going on here? Take a good look at this picture. If this is the way Steve Gilliland (left) and Mike Dotzler play golf, someone else should be organizing the annual Hard Hat Open! Fortunately, the two pranksters were just "goofing around" for the cell-phone camera at the two-person, better-ball tournament held at Don Williams Golf Course, July 23. Jay Beckel and Dan Kayser took first place in the event with a score of 69. Second place went to Tom Ocken and Joel Rieker with a score of 73, while Gilliland and Dotzler took third place with a score of 77. Spot-prize winners were: shortest drive – Nile Beymer; closest to the pin from tee – the team of Grootveld and Grootveld; longest drive, Tom Ocken; closest to pin, 2nd shot – Jay Beckel; and longest putt – the team of Baker and Hall.

Ductile Discovery in "Lord of the Rings" Exhibit

Boston Museum of Science requests yttrium-silver samples for educational display

The mystical world created by author J.R.R. Tolkien in *The Hobbit* and the *Lord of the Rings* trilogy, is a place inhabited by elves, dwarves, wizards and orcs and filled with equally wondrous materials. Among these was a remarkable metal called mithril – elvish for “true silver” – that was highly valued because it was lightweight, but extremely strong. It’s a chain mail shirt made of mithril that saves Frodo from a spear-wielding troll in the first of the three books and subsequent movies.

In the real world, intermetallic alloys have held promise because of their superior chemical, physical, electrical, magnetic, and mechanical properties compared to ordinary metals. However, their extreme brittleness limits their usefulness, although discovery of a ductile intermetallic alloy of yttrium-silver by Karl Gschneidner and Alan Russell shows promise for changing that.

So what’s the connection between Tolkien’s world and Gschneidner’s and Russell’s discovery? The answer is the Internet; in Cyberspace, anything is possible.

It seems that a materials scientist, who is also a big fan of *Lord of the Rings* – LOTR to aficionados – read about the Ames Lab discovery and dubbed yttrium-silver as “the closest thing to mithril that exists in the real world.”

As often happens in Cyberspace, word spread until even the American Chemical Society picked up on it, selecting mithril as the “Molecule of the Week” on April Fool’s Day and mentioning the connection to yttrium-silver.

But the story doesn’t stop there.

When the Museum of Science in Boston was chosen as the only North American site to host “The Lord of the Rings Motion Picture Trilogy Exhibition,” the



The finished yttrium-silver rings took on a deep bronze color. The rings are currently on display at the “Lord of the Rings Movie Trilogy Exhibit” at the Boston Museum of Science. The exhibit, in its only North American appearance, runs through Oct. 24.

museum’s program director, Bill Coleman, went looking for interesting tie-ins for educational programming. He found materials scientists from nearby MIT to talk about forging and heat-treating steel and iron for weapons, but wanted something else. And an Internet search for mithril turned up – you guessed it – Ames Lab’s yttrium-silver.

“The exhibition theme is ‘movie magic,’ and it displays the props and models used in the films and explores the techniques used to make the fantasy,” Coleman says. “Our key mission is bringing science and technology to our visitors and having yttrium-silver on display is a lot of fun and helps our visitors glimpse into the world of cutting-edge metallurgical technology.”

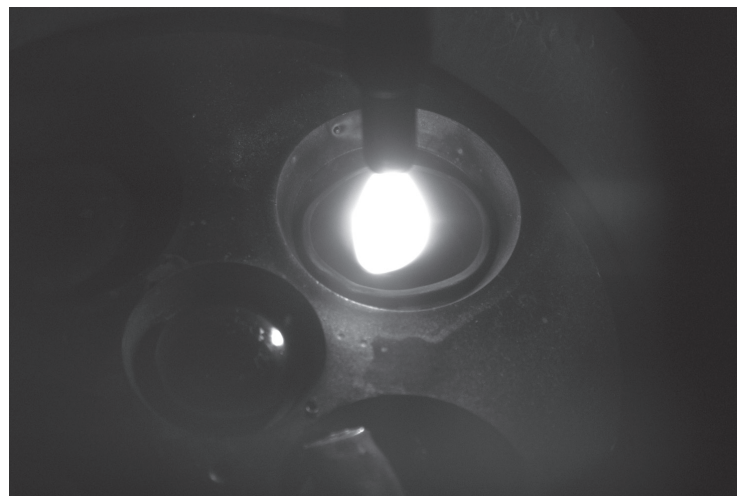
When he initially contacted Ames Lab Public Affairs about getting samples, Coleman asked about creating a small piece of chain mail. Given the uncertainty of how the material would

respond to machining and the time involved, Gschneidner and Materials Preparation Center director Larry Jones decided to try fabricating a few simple rings instead.

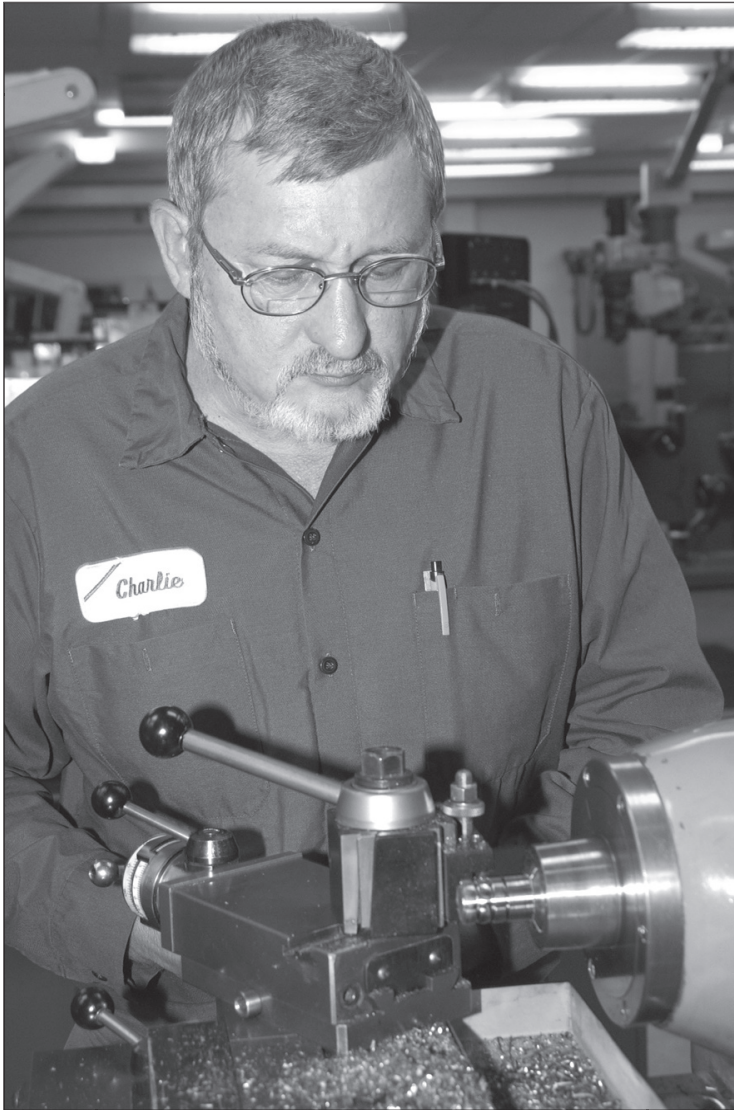
“We had plenty of material on hand,” Jones says, “so it was more a question of whether we’d be able to actually machine it into rings.”

To create the rings, technician Arne Swanson first combined the yttrium and silver into buttons using an arc melter. The buttons were then combined to form an ingot about an inch in diameter and 4 inches long.

Machinist Charlie Burg smoothed the ingot on a metal lathe, *continued on page 5*



The yttrium and silver are combined under vacuum in an arc melter at the Materials Preparation Center and formed into buttons that are then melted to form an ingot.



then formed the outer shape of the rings using a cutting tool designed by engineer Mike Harper. With the rings formed, the inside of the ingot was bored out. Some final trimming and polishing yielded the finished rings.

“The material actually machined pretty well,” Burg says, “similar to a hard brass. It tends to harden as you work it and if you push it too fast, it becomes pyrophoric – it ignites – which is typical of rare-earth alloys.”

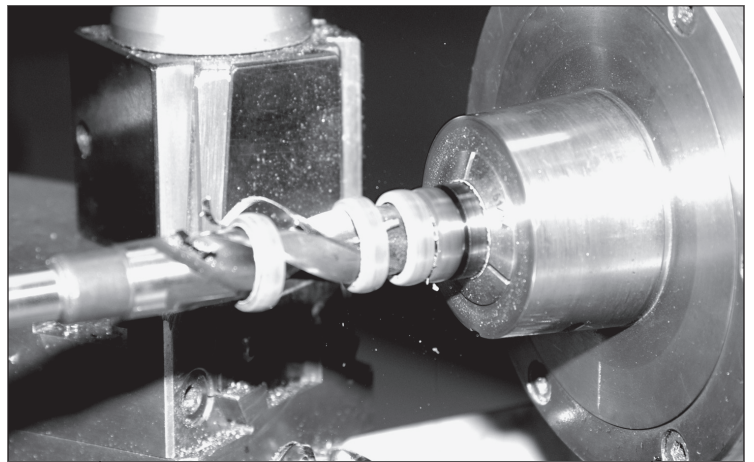
“That’s about what I would have expected based on our

study of the material,” says Gschneidner. “It appeared ductile enough to machine, and fabrication of the rings is further proof of that.”

Unlike its glittering, mythical LOTR counterpart, yttrium-silver develops a deep, bronze-colored oxide, giving the rings a rich, aged appearance.

The LOTR Exhibition opened Aug. 1, and the rings will be on display in Boston with the rest of the exhibit through Oct. 24.

~ by Kerry Gibson



Technician Charlie Burg cuts the outer shape of the rings into the yttrium-silver ingot. The inside of the ingot was then bored out to create the rings.

New Employees

Victor Antonov, visiting scientist (Bruce Harmon)
 Jayeeta Banerjee, research associate I (Marit Nilsen-Hamilton)
 Joanie Burgher, custodian I (Mark Grootveld)
 David Byrd, research technician (Larry Jones)
 Beverly Carstensen, secretary II (Anne Coffman)
 Steven Constance, storekeeper II (Jim Brazelton)
 Audrey Hohanshelt, supervisor nursing services (Steve Sheldahl)
 Mianliang Huang, postdoctoral fellow (Tom Lograsso)
 Adam Kaminski, assistant professor (Bruce Harmon)
 Andreas Kreyssig, postdoctoral fellow (Alan Goldman)
 Marian Lebo, custodian I (Mark Grootveld)
 Jiying Li, postdoctoral fellow (David Vaknin)
 Melissa McCormick, clerk III (Nancy Moore)
 Ambar Mitra, associate professor (Matt Kramer)

Philip Ryan, assistant scientist III (Doug Robinson)
 Weiping Su, postdoctoral fellow (John Verkade)
 Ersan Ustundag, associate professor (Brian Gleeson)

Promotions

Cynthia Feller from clerk IV to secretary IV

Ames Laboratory Hosts Ames Chamber's Business After Hours

For two hours on July 13 members of the Ames Chamber of Commerce immersed themselves in Ames Laboratory and IPRT science. Approximately 50 chamber members and ISU leaders attended the Chamber's Business After Hours event hosted by Ames Lab and IPRT in 205 TASF. Participants spent time eating, chatting and visiting booths set up for the event.

The booths featured Iowa Thin Film Technologies, a Ames-area company that produces flexible, durable and lightweight photovoltaic modules for consumer, electronics, outdoor and recreation, and remote and military markets. Through collaboration, ITFT has had access to various forms of assistance from the Lab and IPRT.

Also on display was toolmark analysis re-

search performed by the Midwest Forensics Resource Center. David Baldwin, MFRC director, showed visitors digital images of toolmarks left by various tools. Toolmark analysis will help forensic experts match marks left by tools at crime scenes to the criminals.

The Center for Catalysis and the Biorenewable Resources Consortium were featured in a third display. Scientists in CCAT and the BRC are collaborating with West Central Cooperative of Ralston, Iowa, on new technologies for the production of biodiesel from soybeans.

~ Steve Karsjen

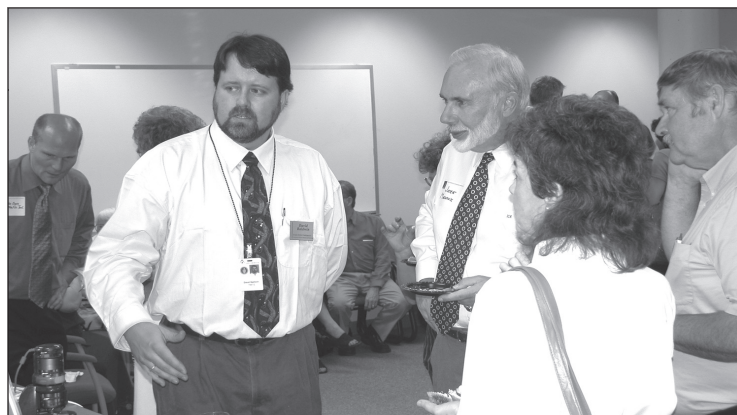


David Maahs, executive director of the Ames Chamber of Commerce (right), listens as Mike Coon, chief operating officer, Iowa Thin Film Technologies, explains the latest advancements in ITFT's solar technology.

(Below) People were often lined up several deep to see digital images of toolmarks and listen to David Baldwin, director of the Midwest Forensics Resource Center (left), explain toolmark analysis.



Director Tom Barton (right) shares a light moment with Jim Bloedel, ISU vice provost for Research and Advanced Studies.



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INSIDER

Newsletter for the Employees of Ames Laboratory ■ Volume 15, Number 7 ■ July-August 2004

Renowned Ames Laboratory and ISU Chemist Gerald J. Small Dies

Gerald J. Small, a senior chemist at the U.S. Department of Energy's Ames Laboratory and a distinguished professor of chemistry at Iowa State University, passed away Saturday, August 7, 2004, at the Israel Family Hospice House in Ames, IA.

Internationally acclaimed for his fundamental studies in both theoretical and experimental physical chemistry, Small joined the faculty of ISU in 1969. Before coming to Iowa, Small, a native of Vancouver, British Columbia, graduated from the University of British Columbia with a BSc degree, with honors in both chemistry and mathematics – a combination of expertise that was a trademark of his remarkable career. After receiving a Ph.D. in physical chemistry from the University of Pennsylvania in 1967, Small was a postdoctoral fellow at the Australian National University in Canberra, Australia.

At ISU, Small's outstanding research quickly brought him national recognition as an Alfred P. Sloan Foundation Fellow from 1974 to 1978, and later election to a Fellow of the American Physical Society. He served on the editorial advisory boards of the *Journal of Chemical Physics*, *Chemical Physics*, the *Journal of Physical Chemistry*, *Chemical Research in Toxicology*, and *Spectrochimica Acta*.

With roots in his graduate thesis research, Small developed novel, powerful spectroscopic tools for the study of such diverse topics as fast solar energy conversion in photosynthetic units, chemical separation techniques, and laser-based bioanalysis of DNA damage and repair in chemical carcinogenesis. His research led to the discovery of incredibly sensitive methods to distinguish between normal cells and cancer cells. Together with his longtime scientific collaborator, Ryszard Jankowiak, Small developed a device that permits detection of DNA-carcinogen interactions at the femtomole level – one molecule out of 100 million! For this

achievement, the scientists were awarded a prestigious R&D 100 Award in 1998.

Small's almost 40 years of truly outstanding research resulted in 287 publications, with 12 of these being generated after he was diagnosed with advanced lung cancer. His research contributions were celebrated in a special issue of the *Journal of Physical Chemistry* (July

22, 2004) that was completely dedicated to him.

More important to Gerry were the six M.S. and 31 Ph.D. students who received their degrees working under his direction and the 15 postdoctoral associates who also benefited tremendously from exposure to his infectious and unbounded enthusiasm for science.

Ames Laboratory Director Tom Barton said, "Iowa State, Ames Lab and science were indeed fortunate to have had the services of this remarkable individual, who tackled everything in life with an intense and enviable passion."

Small is survived by his sons, Eric of Cincinnati and Adam of Denver, and his beloved former wife, Sharon, of San Francisco.

Funeral services for Gerald Small were Thursday, August 12, at St. Cecilia Church in Ames.

